## _Semester 1 Examinations 2015/ 2016_

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| **Exam Code(s)** | 4BCT1 |
| **Exam(s)** | 4th Year Examination Computing Science and IT |
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| **Module Code(s)** | CT421 |
| **Module(s)** | Artificial Intelligence |
| | |
| Paper No. | 1 |
| Repeat Paper | No |

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|---|---|
| External Examiner(s) | Professor Liam Maguire |
| Internal Examiner(s) | Professor G Lyons |
| | Dr. M Madden |
| | *Dr. C Mulvihill |
| | *Dr. F Smith |

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| **_Instructions_:** | Answer 2 questions from each section. All questions will be marked equally. Use a separate answer book for each section. |

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| **_Duration_** | 2 hours |
| **No. of Pages** | 3 |
| **Discipline(s)** | IT |
| **Course Co-ordinator(s)** | |

**Requirements**:

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|---|---|
| MCQ | Release to Library:  Yes ☐   No ☐ |
| Handout | None |
| Statistical/ Log Tables | None |
| Cambridge Tables | None |
| Graph Paper | None |
| Log Graph Paper | None |
| Other Materials | None |
| Graphic material in colour | Yes ☐   No ☐ |

**PTO**

## Section A

1
(a)
How does Fuzzy Logic 'soften' the boundary between rules? (10 marks)
(b)
Explain how fuzzy logic rules can control complex systems. (10 marks)
(c)
Consider the assertion "Boolean logic is just a special case of fuzzy logic". Do you think this is true? Explain your answer. (5 marks)


2
   a) Describe the aims of GDE?
      (4 marks)

   b) Why are multiple faults harder to diagnose than single faults?
      (3 marks)

   c) Briefly describe how GDE is used to suggest faults in static systems.
      (10 marks)

   d) i) How can GDE distinguish between multiple candidate sets?
      (4 marks)
      ii) How do Sherlock and GDE+ improve upon GDE?
      (4 marks)


3
(a)
How does AI search differ from searches that are applied to data structures? (5 marks)
(b)
What are the differences between Forward Chaining and Backward Chaining? Give an example of a situation when each would be suitable and a separate example of when both would be suitable.(10 marks)
(c)
Describe 5 different sources of uncertainty in reasoning. (10 marks)

## Section B

4

   (a) Explain what is meant by the term 'greedy search' (7 marks)

   (b) By considering the cycle graph C6, show how one ordering for vertices will give an optimal colouring for a greedy searcher, and another will not. Note: The conditions on the search are that adjacent nodes must have different colours and that the least possible number of colours is preferred (12 marks)

   (c) Explain what is meant by the term 'minimax' and apply your definition to discover the minimax value for the following complete binary search tree: bottom leaf node values 2,3, 4, 5, next level up is a MIN level, final level up is a MAX level (6 marks)

5

   (a) In the context of genetic algorithms, explain what is meant by the term 'roulette wheel selection' (5 marks)

   (b) A software bot (like Mitchell's example) is to be developed for collecting rubbish in a 10 by 10 two-dimensional array. A cell of this array can be empty, contain rubbish, or contain a wall. In terms of context, a bot can see the contents of the current cell, and the contents of one cell north, south, east and west. In terms of actions, a bot can: Move one cell north, south, east, west, or move one step randomly (north, south, east, or west), pick up the rubbish in the current cell, or do nothing. A reward of 10 points results from picking up rubbish. However a fine of one point results if the bot's action is to pick up rubbish and there is in fact no rubbish in the cell. A fine of 5 points results from crashing into a wall. Discuss in full the development of a suitable genetic algorithm for evolving this bot. Note: There are 243 situations for the bot, as North, South, East, West and the current cell can be empty, contain rubbish, or contain a wall. (15 marks)

   (c) Can a genetic algorithm fail to find a solution? (5 marks)

6

"Aristo, Cepheus, Knewton, and Watson represent visions of the future for Artificial Intelligence" Discuss this statement from the following four perspectives: Benchmarking AI (6 marks), game playing (7 marks), digital assistants (6 marks), data mining (6 marks) (25 marks in total)